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Evaluation of Certain Technical Factors Affecting Commercial Production of Pickled Papaya from *Carica papaya* Fruit

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ABSTRACT

Papaya belongs to family Caricaceae scientifically known as Carica papaya Linn. It contains different phytochemical constituents including proteases, lycopenes, carotenoids, alkaloids, monoterpenoids, flavonoids, minerals and vitamins. Its pulp has a pleasant flavor. After ripening, this fruit softens immediately. Perishable nature of papaya fruit limits it from commercial distribution. One investigation surveyed a lactic fermentation from papaya fruit by penetrating on the efficacy of various variables such as blanching duration and temperature, sugar concentration, lactic fermentation duration to total phenolic, total flavonoid, organoleptic property of pickled papaya fruit. Results of ther present study showed that blanching raw papaya fruit in hot water, heated at 95oC for 20 seconds with 1.0% CaCl2, 7% sugar, in 15 days of lactic fermentation were adequate to achieve an overall acceptance of pickled papaya. Papaya pickle can be an ideal choice of our daily cuisine.

KEY WORDS: *PAPAYA FRUIT*, LACTIC FERMENTATION, SUGAR, BLANCHING, TOTAL PHENOLIC, TOTAL FLAVONOID, ORGANOLEPTIC.

INTRODUCTION

Papaya, *Carica papaya* fruit is a rich source of vitamins A and C. It also contains thiamine, riboflavin, calcium, iron, potassium, magnesium and sodium (Bari et al., 2006). Raw papaya is a good source of carbohydrates, vitamins and proteins, and the content decreases as it ripens. Raw papaya has a large amount functional constituents such as saponin, alkaloid, tannin, β-carotene, lycopene, anthocyanin, flavonoid and polyphenol beneficial for human health (Chukwuka et al., 2013; Pavithra et al., 2017).

These bioactive elements are responsible for the pharmacological properties useful in daily intake and alimentation. Papaya is considered as nutraceutical fruit due to its multifaceted medicinal properties (Mahendra et al., 2016). Papaya acts as an antioxidant, antimicrobial, anticarminative, anticancer, and has hepato-protective, immunological, and other therapeutic attributes. The seed and pulp of papaya have bacteriostatic effects against several enteropathogens, such as *Bacillus subtilus* and *E. coli*, (Saeed et al., 2014).

Lactic acid bacteria metabolizes the sugar elements of fruit into lactic acid, which decreases the pH of the pickled products to ensure shelf-life. Lower pH value limits the growth of spoilage flora and pathogenic bacteria. These bacteria enhance the human intestinal microbial balance

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and improve health by inhibiting the proliferation of pathogens such as Escherichia coli, Salmonella and Staphylococcus (Ohmomo et al. 2000, Ross et al. 2002). They are normally believed as probiotic, beneficial for our health and active in lowering the serum cholesterol level (Kaur et al. 2002). They also stimulate immune responses and prevent tumour formation by inhibiting carcinogenic compounds in the gastro-intestinal tract through reducing fecal bacteria enzyme activity (Nakphaichit et al. 2011) or breaking down certain enterotoxins (Bernardeau et al. 2006). The fermented vegetables or pickle products provided probiotics to the consumers (Chaiyavat Chaiyasut, 2018).

Papaya fruit is an underutilized agricultural product contaning high fermentable sugar composition ideal for lactic fermentation. One study compared total phenolic, total flavonoid, β-carotene, lycopene, ascorbic acid contents and antioxidant properties between fresh and pickled papaya. The pickling process of papaya caused a significant decrease in their antioxidant component and activity (Nurul and Asmah 2012). Hence in the presently undertaken study, the effect of various variables such as blanching duration and temperature, sugar concentration, fermentation duration to total phenolic, total flavonoid, organoleptic property of pickled papaya fruit have been examined from a commercial utitly point of view.

MATERIAL AND METHODS

Papaya fruits, Carica papaya were cultivated and harvested from Hau Giang province, Vietnam. They were cultivated following VietGAP, without using insecticides or herbicides to ensure food safety regulations. After harvesting, they were conveyed to laboratory as soon as possible for further experiments.

Effect of blanching temperature and duration to total phenolic, total flavonoid and organoleptic property of pickled papaya: Papaya fruits were peeled to remove green outer, sliced into pieces (0.5 cm in thickness) and pre-treated by thermal blanching in hot water containing 1.0% $CaCl_2$ with different duration and temperature (100°C in 10 seconds, 95°C in 20 seconds, 90°C in 30 seconds and 85oC in 40 seconds). Effectiveness of blanching duration and temperature in papaya fermentation was evaluated on value of total phenolic (mg/g), total flavonoid (mg/g) and organoleptic property (sensory score).

Effect of sugar concentration in fermentation to total phenolic, total flavonoid and organoleptic property of pickled papaya: Papaya fruits were fermented with different sugar concentration (3%, 5%, 7%, 9%). Effectiveness of sugar concentration in papaya fermentation was based on value of total phenolic (mg/g), total flavonoid (mg/g) and organoleptic property (sensory score).

Effect of fermentation duration to total phenolic, total flavonoid and organoleptic property of pickled papaya: Papaya were fermented with different fermentation time (5, 10, 15, 20 days). Effectiveness of fermentation duration in papaya fermentation was based on value of total phenolic (mg/g), total flavonoid (mg/g) and organoleptic property (sensory score).

Chemical, sensory evaluation and statistical analysis: Total phenolic (mg/g) were determined using Folin–Ciocalteu reagent as gallic acid equivalents (GAE). The spectrophotometer assay for the quantitative determination of flavonoid content (mg/g) was carried out as catechin equivalents. Sensory score of pickled product was assessed by a group of panelist using the 9-point Hedonic scale. Data were statistically summarized by Statgraphics Centurion XVI.

RESULTS AND DISCUSSION

Effect of blanching temperature and duration to total phenolic, total flavonoid and organoleptic property of pickled papaya: Blanching was a quick thermal treatment widely applied before processing to inactivate internal enzymes and to kill harmful microbial existing in raw material (Saltveit 2000). Popularly hot water blanching

Table 1. Showing the effect of variables: blanching, temperature and duration to total phenolic, total flavonoid and organoleptic contents of *Pickled papaya*

Blanching temperature and duration	Total phenolic content (mg/g)	Total flavonoid content (mg/g)	Sensory score
100oC, 10 seconds	71.15±0.03^b	21.33±0.00^b	4.52±0.00^b
95oC, 20 seconds	75.49±0.00^a	24.59±0.01^a	6.39±0.03^a
90oC, 30 seconds	67.82±0.01^c	18.48±0.03^c	3.24±0.01^c
85oC, 40 seconds	61.09±0.02^d	14.73±0.01^d	2.77±0.02^d

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α= 5%).

method was used in the food processing of fruits and vegetables (Prakash Kumar et al. 2018).

Papaya were peeled to remove green outer, sliced into pieces (0.5 cm in thickness) and pre-treated by blanching in water containing 1.0% CaCl2 with different duration and temperature (100oC in 10 seconds, 95oC in 20 seconds, 90oC in 30 seconds and 85oC in 40 seconds). Efficay of blanching duration and temperature in papaya fermentation was estimated on total phenolic (mg/g), total flavonoid (mg/g) and organoleptic property (sensory score). Results are elaborated in table 1. It's obviously noticed that blanching at 95oC in 20 seconds was optimal for papaya fermentation. So we used this value for further experiments.

Table 2. Effect of Sugar concentration (%) on total phenolic, total flavonoid, organoleptic contents of *Pickled papaya*

Sugar concentration (%)	Total phenolic content (mg/g)	Total flavonoid content (mg/g)	Sensory score
3	75.49±0.00^{c}	24.59±0.01^{c}	6.39±0.03^{c}
5	79.42±0.03^{b}	26.13±0.03^{b}	7.21±0.00^{b}
7	80.35±0.01^{a}	28.36±0.00^{a}	8.14±0.03^{a}
9	79.93±0.02^{ab}	27.58±0.01^{ab}	7.89±0.01^{ab}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α= 5%).

Effect of sugar concentration in fermentation to total phenolic, total flavonoid and organoleptic property of pickled papaya: In the pickling industry, sugar has been popularly applied for lactic fermentation of various fruits and vegetables (Hudson et al 1985, Fleming et al., 1995; Mcfeeters et al., 1993). It is an essential ingredient to improve the preservative, technological and sensory quality of food (Brady 2002). It's one of the most widely additives for food preservation to increase product shelf-life by decreasing water activity. During pickling, sugar addition will affect the carbohydrate contents. Some vegetables are deficient in sugars and are liable to develop undesirable types of bacteria unless a small amount of sugar is added (Sultana et al., 2014).

Papaya were fermented in various sugar concentration (3%, 5%, 7%, 9%). Effectiveness of sugar concentration in papaya fermentation was based on total phenolic (mg/g), total flavonoid (mg/g) and organoleptic property (sensory score). Results were revealed in table 2. It's thoroughly realized that 7% sugar was adequate for papaya fermentation. So we decided to choose this parameter for further experiments.

Table 3. Effect of Fermentation duration (days) on the total phenolic content, total flavonoid content and sensory score of pickled papaya

Fermentation duration (days)	Total phenolic content (mg/g)	Total flavonoid content (mg/g)	Sensory score
5	80.35±0.01^{b}	28.36±0.00^{b}	8.14±0.03^{b}
10	81.46±0.03^{ab}	29.53±0.02^{ab}	8.45±0.01^{ab}
15	82.11±0.00^{a}	30.19±0.01^{a}	8.68±0.00^{a}
20	82.17±0.02^{a}	30.23±0.00^{a}	8.37±0.02^{ab}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α= 5%).

Effect of fermentation duration to total phenolic, total flavonoid and organoleptic property of pickled papaya: Naturally occurred lactic acid bacteria from the raw material play an important role in lactic fermentation. Papaya were fermented with different fermentation time (5, 10, 15, 20 days). Efficacy of fermentation duration in papaya fermentation was based on value total phenolic (mg/g), total flavonoid (mg/g) and organoleptic property (sensory score). Results were mentioned in table 3. It's obviously revealed that 15 days of fermentation was adequate for papaya fermentation. So we selected this variable for application. The present results are quite different with one report. The pickling process of papaya caused a significant decrease in their antioxidant component and activity (Nurul and Asmah 2012).

CONCLUSION

The fermentation process of pickles is very simple and there is no need for specific equipment. Pickling is one of the most effective ways for fruit and vegetable preservation. Pickle is the good source of antioxidants, probiotics, vitamins, and minerals beneficial for our health. Lactic acid fermentation is believed as a simple and useful biotechnology to improve the safety, nutritional, sensory and stability attributes of papaya fruit. Pickle papaya is a good appetizers and adds to the palatability of the meal. It can also stimulate the flow of gastric juice and thus helps in digestion.

REFERENCES

Bari, L., P. Hassan, N. Absar, M.E. Haque and M.I.I.E. Khuda (2006). Nutrional analysis of two varities of papaya (Carica papaya) at different maturation stages. Pakistan Journal of Biological Science 9: 137-140.

Bernardeau, M., M. Guguen and J.P. Vernoux (2006). Beneficial lactobacilli in food and feed: long-term use, biodiversity and proposals for specific and realistic safety assessments. FEMS Microbiology Reviews 30: 487–513.

Brady M (2002). Sodium survey of the usage and functionality of salt as an ingredient in UK manufactured food products. British Food Journal 104: 84-125.

Chaiyavat Chaiyasut, Periyanaina Kesika, Sasithorn Sirilun, Sartjin Peerajan, Bhagavathi Sundaram Sivamaruthi (2018). Formulation and evaluation of lactic acid bacteria fermented Brassica juncea (Papaya) pickle with cholesterol lowering property. Journal of Applied Pharmaceutical Science 8: 033-042.

Chukwuka, K.S, Iwuagwu, M and Uka, U.N (2013). Evaluation of nutritional components of Carica papaya L. at different stages of ripening. IOSR Journal of Pharmacy and Biological Sciences 6: 13-16.

Saeed F, Muhammad Umair Arshad, Imran Pasha, Rabia Naz, Rizwana Batool, Ammar Ahmed Khan, Muhammad Adnan Nasir & Bilal Shafique (2017). Nutritional and phyto-therapeutic potential of papaya (Carica papaya Linn.): An overview. International Journal of Food Properties 17: 1637-1653.

Fleming HP, Mcdonald LC, Mcfeeters RF, Thompson RL, Humphries EG (1995). Fermentation of cucumbers without sodium chloride. Journal of Food Science 60: 312-319.

Hudson JM, Buescher RW (1985). Pectic substances and firmness of cucumber pickles as influenced by CaCl2, NaCl and brine storage. Journal of Food Biochemistry 9: 211-215.

Kaur, I.P., K. Chopra and A. Saini (2002). Probiotics: potential pharmaceutical applications. European Journal of Pharmaceutical Sciences 15: 1–9.

Mahendra C. Gunde, Nikhil D. Amnerkar (2016). Nutritional, medicinal and pharmacological properties of papaya (Carica papaya linn.): A review. Journal of Innovations in Pharmaceuticals and Biological Sciences 3: 162-169.

Mcfeeters RF, Fleming HP. Balancing macro mineral composition of fresh-pack cucumber pickles to improve nutritional quality and maintain flavor. Journal of Food Quality 1997; 81-89.

Nakphaichit, M., S.C. Thanomwongwattana, N. Phraephaisarn, S. Sakamoto, J. Keawsompong, S. Nakayama and S. Nitisinprasert (2011). The effect of including Lactobacillus reuteri KUBAC5 during post-hatch feeding on the growth and ileum microbiota of broiler chickens. Poultry Science 90: 2753–2765.

Nurul, S. R. and Asmah, R. (2012). Evaluation of antioxidant properties in fresh and pickled papaya. International Food Research Journal 19: 1117-1124.

Ohmomo, S., S. Murata, N. Katayama, S. Nitisinprasart, M. Kobayashi, T. Nakajima, M. Yajima and K. Nakanishi (2000). Purification and some characteristics of enterocin ON-157, a bacteriocin produced by Enterococcus faecium NIAI 157. Journal of Applied Microbiology 88: 81–89.

Pavithra CS, S Suchiritha Devi, Jessie Suneetha W and Ch. V Durga Rani (2017). Nutritional properties of papaya peel. The Pharma Innovation Journal 6: 170-173.

Prakash Kumar Nayaka, Chandrasekar Chandra Mohanb, and Kesavan Radhakrishnan (2018). Effect of microwave pretreatment on the color degradation kinetics in mustard greens (Brassica juncea). Chemical Engineering Communications 205: 1261–1273.

Ross, R.P., S. Morgan and C. Hill (2002). Preservation and fermentation: past, present and future. International Journal of Food Microbiology 79: 3–16.

Saltveit, M.E (2000). Saltveit, M.E. Wound induced changes in phenolic metabolism and tissue browning are altered by heat shock. J. Food Sci. Technol. 21: 61–69.

Sultana, S., Iqbal, A. and Islam, M. N. (2014). Preservation of carrot, green chilli and brinjal by fermentation and pickling. International Food Research Journal 21: 2405-2412.